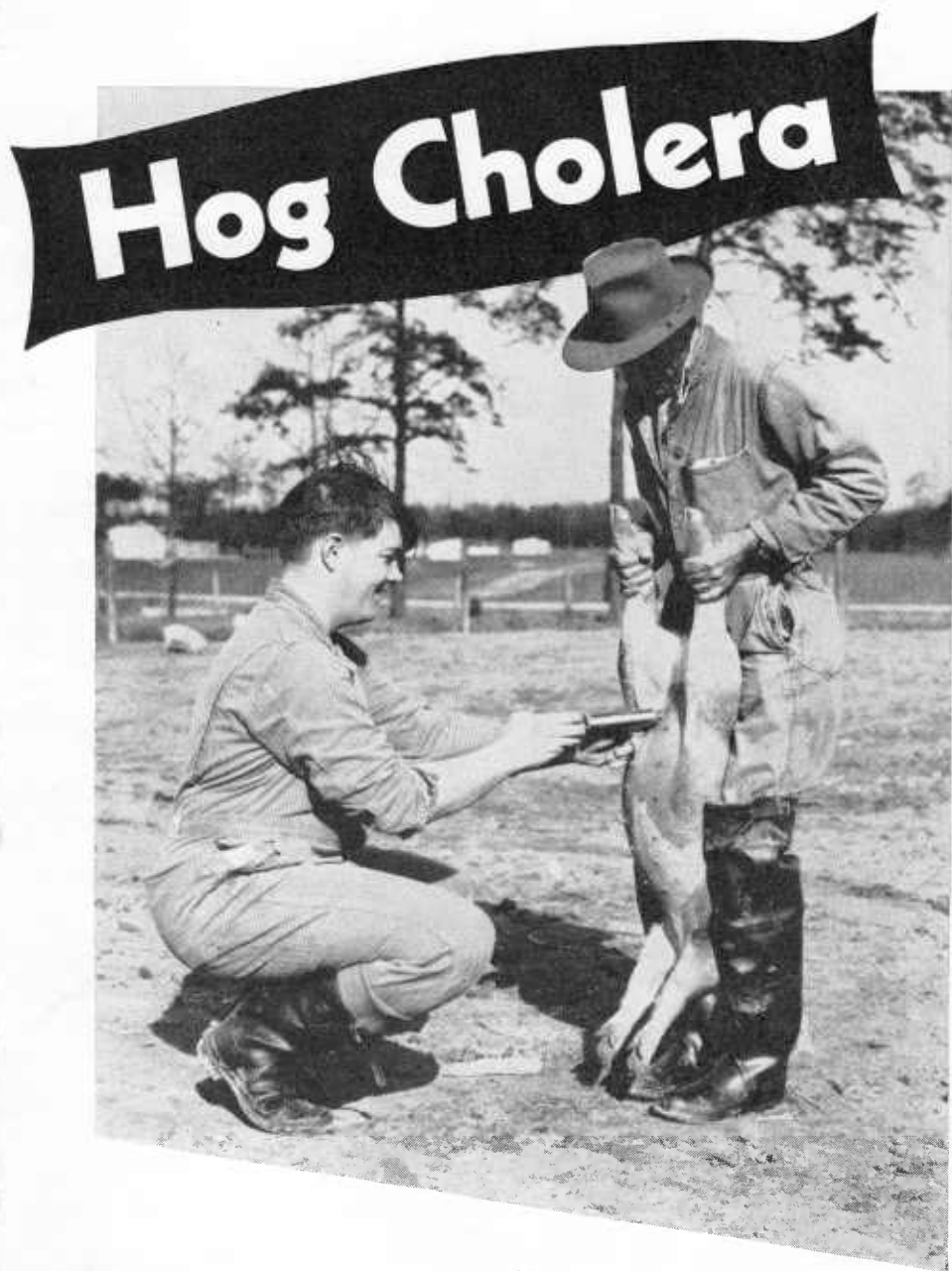


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Farmers' Bulletin No. 834

U. S. DEPARTMENT OF AGRICULTURE

HOG CHOLERA destroys more hogs in the United States than all other diseases combined. The losses have amounted to more than 6,000,000 hogs in one year, and the money losses reach many millions of dollars yearly.

In many ways the carrying of hog cholera from farm to farm can be avoided if proper care is exercised. Chief among them are sanitation, disinfection, and self-imposed quarantine.

The Federal Government and the State authorities are endeavoring to reduce losses to a minimum. Cooperation by all concerned is essential to success.

The Bureau of Animal Industry made a study of the disease and by 1910 had developed anti-hog-cholera serum, which is a thoroughly tested and reliable preventive agent. Vaccines were first developed in the thirties and their use is increasing.

Although means have now been found to protect swine against cholera, the cost of this protection added to the losses from the disease constitutes a staggering load on the swine industry, and ultimately on the consumer of pork in its various forms.

For these reasons, serious attention is now being directed toward efforts to eradicate the disease. A Committee on the Eradication of Hog Cholera has been appointed by the U. S. Livestock Sanitary Association, and plans are being formulated for the eventual eradication of hog cholera.

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Hog Cholera

By C. G. COLE, *Pathological Division, Bureau of Animal Industry,
Agricultural Research Administration*¹

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PREVALENCE

HOG CHOLERA, the most serious disease of hogs, is found in practically all parts of the world, though in some parts outbreaks are rare, and are stamped out by slaughter of infected animals and quarantining of premises. That method of control is not used in this country, where the disease, since its first appearance in Ohio in 1833, has spread to every State in the Union. Cholera is most prevalent in the States of the Middle West and of the South, where hogs are raised in greatest numbers. The Pacific Coast States remained practically free from hog cholera until recent years, probably because of the limited production of hogs and limited importations from the infected districts of the country.

In the South, where the winters are mild and the temperatures more or less uniform, severe outbreaks of hog cholera may occur at any season of the year. Statistics collected from experiments conducted in 14 States, principally in the Middle West, show, however, that the disease reaches its greatest height during October and November. After this time it dies down rapidly, and reaches its lowest point during February.

LOSSES FROM HOG CHOLERA

Although hog cholera has been present in this country continually for more than 100 years, it has been unusually prevalent in certain periods. The first period of exceptional prevalence reached its climax in 1887, the second in 1897, and the third in 1913 and 1914. During these periods the hog-raising industry throughout the country suffered great losses and in some localities was for a time practically destroyed. Again in the fall of 1926 the disease became unusually

¹ This is a revision of two former editions, the first by M. Dorset (deceased), U. G. Houck (deceased), and W. M. MacKellar (retired); the second by C. G. Cole, C. N. Dale, and R. R. Henley.

prevalent, especially in the Middle West. Owing to the inadequate supply of serum to meet the unusual demand, losses were heavy in some sections.

The value of hogs destroyed by cholera in the United States has amounted to about \$65,000,000 in a single year, and for any 10-year period the average annual loss probably was not less than \$20,000,000. This represents merely the direct losses; if the indirect losses could be computed, these figures would be greatly increased.

CAUSE OF HOG CHOLERA

Hog cholera is a highly contagious disease of swine, caused by a virus which is present in the blood, urine, feces, and secretions of the eye and nose of a hog affected with cholera. It is accompanied by fever, is highly fatal to hogs, but, so far as known, other animals—including man—do not contract the disease under natural conditions. Rabbits injected with hog-cholera virus may develop a fever, but show no other symptoms. It has been asserted that certain breeds of hogs are immune, but experiments have proved that all breeds of hogs are naturally susceptible to the disease, although there may be a considerable difference in the degree of susceptibility of different individuals.

Until recently no method of cultivating the virus by artificial methods was known. However, the virus has been grown successfully in laboratories. The virus has not been seen, even with the most powerful optical microscope; it passes readily through the pores of very fine filters, which will hold back all visible bacteria; and it is known only by the effects which it produces. In these respects it resembles the viruses that cause foot-and-mouth disease and rinderpest in cattle. Although insanitary surroundings and improper feeding tend to lower vitality and may thus render animals less able to withstand the disease, such conditions cannot of themselves cause hog cholera. It can be produced only by the specific virus of hog cholera.

SYMPTOMS SHOWN BY HOGS SICK WITH CHOLERA

The symptoms of hog cholera differ in different hogs and in different herds, depending on the strength of the virus and the ability of the animals to withstand the disease. As a result of these variations the disease has been said to exist in two forms—acute and chronic. In the acute or severe type hogs sicken and die quickly. In the chronic or less severe type hogs may be sick for weeks or months before they succumb.

When cholera appears in a herd, the hogs do not all become sick at once, but, on the contrary, at first only a few refuse to come up to feed with the herd. The sick ones remain in the nest and when driven from the bed their backs may be arched, and they may appear cold and shiver. The rest of the herd may remain apparently well for several days, when others are likely to be found affected in about the same way as those first attacked. As the disease progresses the sick hogs become gaunt or tucked up in the flank and have a weak, staggering gait; the weakness being most noticeable in the hind legs.

If the lungs are affected there may be a cough, which is particularly noticeable when the hogs are disturbed. The eyes usually are

inflamed and show a discharge, which may cause the lids to stick together.

Constipation, which is commonly present in the early days of the disease, is usually followed by a diarrhea. As the disease reaches its height red or purplish blotches may appear on the skin of the ears, of the belly, and of the inner surfaces of the legs.

Some of the symptoms mentioned may be present in other diseases, but the owner should remember that cholera spreads rapidly through a herd and no time should be lost in calling a veterinarian to diagnose the disease and administer the proper treatment. If the disease is cholera, heavy losses can be averted only by prompt immunization of the herd.

The temperature of the hogs is of much importance in diagnosing cholera. The normal temperature in ordinary weather, when the hogs are not excited or worried, ranges from 101° to 103° F., but when cholera is present it is not uncommon to find a large proportion of the hogs with temperatures from 104° to 107°, and even higher. The temperature may fall below normal in the late stage of the disease.

PERIOD OF INCUBATION

The true period of incubation is the time elapsing between the entrance of the virus into the body and the appearance of symptoms of the disease. In the tests conducted by the Bureau of Animal Industry, virus was injected into the bodies of susceptible shotes. Adopting the time of the appearance of visible symptoms as the end of the period of incubation, it was observed that the shortest period from the time the virus was injected until the appearance of visible symptoms was 3 days and the longest was 7 days. In 95 percent of the 171 shotes used in the experiment, the incubation period ended on the fourth, fifth, or sixth day. When susceptible swine are exposed by contact or other natural channels, it is impossible to know the exact time when infection occurs, but visible symptoms are rarely observed within less than 5 or 6 days after such exposure.

APPEARANCE OF A HOG AFTER DEATH FROM CHOLERA

An examination of carcasses of hogs that die assists in determining whether they have died of cholera, but it is desirable to kill a sick hog for autopsy if there is any doubt as to the diagnosis. It is important also that the condition of the entire herd be considered before making a diagnosis. In making a post mortem examination, first place the carcass on its back and examine the skin for purple blotches resembling a birthmark. Then the carcass should be opened from the throat to the tail, exposing the internal organs without cutting them.

Any or all of the changes described may be found in a hog which has died from hog cholera, but it is rare to find all in any one case. In the lingering or chronic cases of hog cholera it is usual to find the intestinal, buttonlike ulcers. The blood-colored spots described are, as a rule, found in the acute cases. Often more than one post mortem is necessary to make a diagnosis.

LUNGS

In acute cholera the surfaces of the lungs frequently show small, red spots (petechiae) varying in size from that of a pinhead to that of a small pea. These spots cannot be washed off, and when found are an important indication of cholera. It is not unusual, instead of finding the lungs soft, filled with air, and pinkish in color, as is the case in a normal condition, to find parts of them solid and of a grayish or dark-red color, which results from a form of pneumonia. This condition, however, is not so characteristic of hog cholera as the reddish spots mentioned.

HEART

When removed from the membranous sac surrounding it the surface of the heart may show blotches or blood spots such as those on the lungs. They are usually seen only in the acute form of hog cholera and are not always present.

LIVER

The liver generally shows no changes that can be regarded as characteristic of cholera. The gall bladder may show petechiae on the inner surface.

SPLEEN, OR MELT

In acute cases of hog cholera the spleen, or melt, is often large, dark, and soft. In chronic cases, however, it may be smaller than normal and grayish in color. In many cases small dark-colored elevated areas known as hemorrhagic infarcts are observed.

KIDNEYS

The kidneys are surrounded by a thin, fibrous tissue. This should be peeled off carefully to avoid injury to the surface of the kidney. Then examine for dark-red spots (petechiae) varying in size from mere points to areas as large as the head of a pin. The spots may be few, or the surface of the kidneys may be as speckled as a turkey's egg. These spots on the kidneys are very commonly present in acute cases of hog cholera but are sometimes absent in pigs killed in the early stages of the disease (fig. 1).

BLADDER

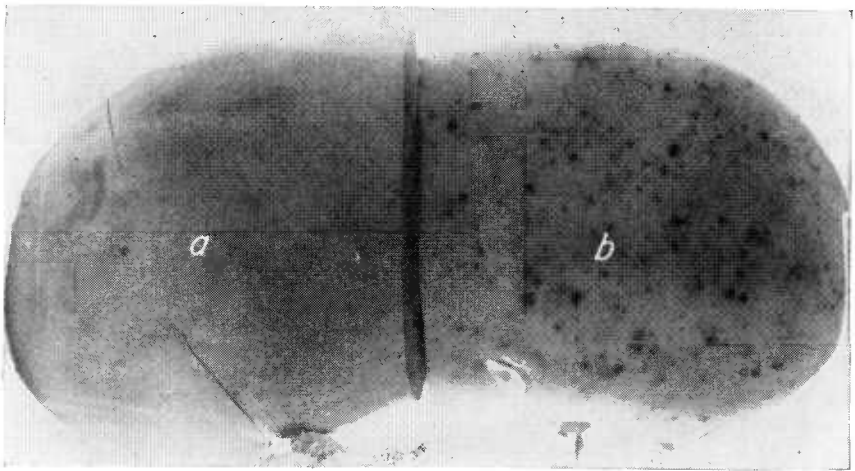
The inner surface of the bladder under normal conditions is white or a faint pinkish white in color, but in well-marked cases of hog cholera it may show bright-red specks which cannot be washed off.

STOMACH

In some cases of hog cholera, when the stomach is opened and washed out, red spots and ulcerations may be found on the inner surface. Usually the stomach shows some inflammation, but since this occurs in other diseases also, it cannot be regarded as characteristic of cholera.

SMALL INTESTINES

In some acute and virulent types of hog cholera the outer surface of the small intestines may have the appearance of being spattered



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Figure 1.—Hog's kidney: *a*, Normal kidney; *b*, section showing blood spots caused by hog cholera.

with blood. The bloody spots, however, cannot be removed by washing. The inner lining may be congested, inflamed, greatly thickened, and covered with a yellowish coating; or it may be dotted with small blood spots like those seen on the outer surface.

LARGE INTESTINES

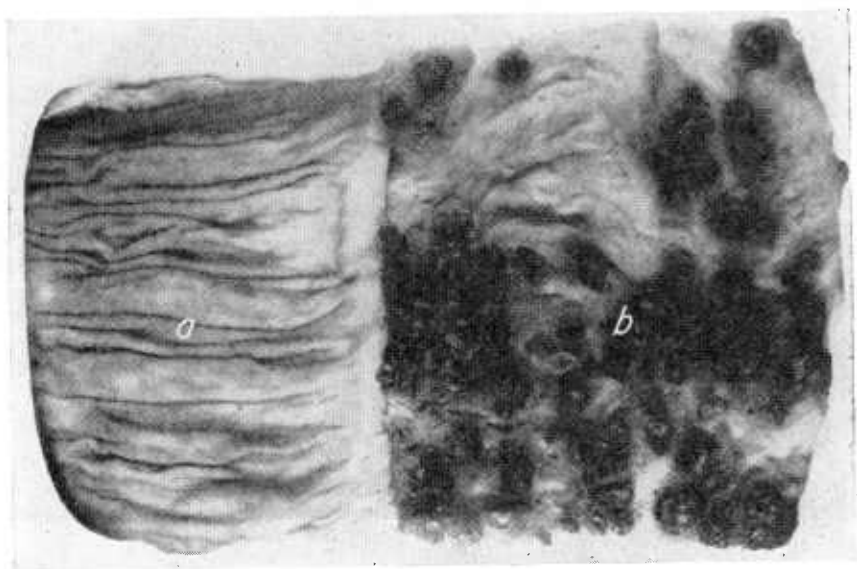
The large intestines may show, over the outer surface, the same characteristic blood spots as are seen at times on the small intestines. The inner surface in acute cases of hog cholera also may show small, blood-stained areas, and in addition to this the feces found in this part of the bowel may be streaked with blood.

In chronic cases, where the hog has been sick for some time, there are usually found on the inner surface of the large intestines, especially in the region of the ileocecal valve, round, hard areas called "button ulcers" (fig. 2). These ulcers are raised above the surrounding tissue and usually are yellowish in color, while the larger ones may have dark centers. The ulcers vary in size from one-sixteenth of an inch to 1 inch in diameter. They must not be confused with the lesions of necrotic enteritis.

LYMPH NODES

The changes which take place in the lymph nodes as a result of hog cholera frequently are striking. The most important nodes to be examined are the lymph nodes in the cervical region and the inguinal nodes in the fat just under the skin of the belly in the region of the flanks. In health, these nodes are of a rather light-grayish color; in cases of cholera they may be enlarged and red, and in severe

cases they may appear almost black. If these glands are cut through with a knife, it will usually be found that the outer part, or rind, is most affected. Other lymph nodes which undergo similar changes



10920-D

Figure 2.—Intestines of hogs: *a*, Normal section; *b*, intestine showing ulcers of hog cholera.

are found in the fatty tissues at the angle of the lower jaw and in the thin membrane which holds the intestines together.

BONES

The bones are congested, as may be seen by cutting through the breast bone.

DISEASES WHICH MAY BE MISTAKEN FOR HOG CHOLERA

Although any or all of the changes which have been described may be found in a hog which has died from hog cholera, it is rare to find all of them in any one case. It is therefore difficult even for trained and experienced veterinarians to differentiate hog cholera from some other diseases and conditions that affect swine. Furthermore, cholera is often found complicated with other diseases or conditions. More than one post mortem examination is often necessary to make a diagnosis.

Among the diseases and conditions which should be considered when making a diagnosis are the following:

HOG "FLU" (INFECTIOUS BRONCHITIS, SWINE INFLUENZA)

Hog "flu" is a herd disease, usually attacking all or nearly all of the animals in the herd at the same time, which is not the case in outbreaks

of cholera. There is a sudden prostration and loss of appetite. Spasmodic breathing, or "thumps," is usually observed. When forced to move, the affected animals have violent fits of coughing and often attempt to vomit. The mucous membranes of the eyes are red, and the eyes show a watery discharge. There may be a discharge from the nose, often streaked with blood. The temperatures in the height of typical outbreaks range from 104° to 108° F. If the animals are given proper care the disease is of short duration, and the losses are not heavy.

ANTHRAX

Although anthrax in hogs usually occurs in a chronic or subacute form with lesions confined principally to the region of the throat, an acute septicemic type of the malady may readily be mistaken for the acute form of hog cholera.

In the acute form, symptoms which appear suddenly include a rise in temperature, loss of appetite, depression, chills, and muscular tremblings. On post mortem examination, the cervical and mesenteric lymph nodes may be enlarged, edematous, and hemorrhagic, having a brownish-red color. In some cases, the spleen may be enlarged, dark in color, and soft. There may be a marked enteritis. One of the distinguishing features of anthrax in hogs is the marked swelling of the throat and tongue, with frequently a bloodstained, frothy discharge from the mouth.

Anthrax in swine usually follows the appearance of the disease in other animals on the farm; thus the disease is most commonly the result of feeding on a carcass of an animal dead of anthrax, of following infected cattle during an outbreak, or of deep rooting on infected pastures during the spring season.

However, a sporadic outbreak in swine may occur as a primary infection without involvement of other types of livestock. During the winter of 1952, numerous outbreaks of this nature due to contaminated mixed feed occurred in Iowa, Illinois, Michigan, Indiana, and Ohio.

Anthrax is transmissible to man, and animals showing symptoms resembling those of anthrax should not be autopsied or otherwise handled. If anthrax is suspected, notify livestock sanitary authorities immediately.

NECROTIC ENTERITIS

At one time the condition commonly called "necro" was considered to be a specific disease, but further research indicates that there are at least three specific diseases in which lesions of necrotic enteritis may occur. These lesions most commonly affect the inner lining of the large intestine, but occasionally the lining of the small intestine also is involved. Sometimes grayish areas may be seen through the outer covering of the large intestine, and on cutting it open the inner lining is found to be studded with grayish, dead patches ready to slough off, but they do not form the characteristic, buttonlike ulcers seen in some cases of chronic hog cholera. Sometimes the entire inner lining is covered with necrotic lesions.

Lesions of necrotic enteritis may occur in *Salmonella choleraesuis* infection. This disease is caused by one of the paratyphoid germs.

Pigs affected with the acute form of this disease have little or no appetite and high fever. Within a few days some of the animals may die; whereas others appear to recover, their appetites improve, and they become more active. The skin, lymphatic glands, and internal organs of the pigs that die early are affected with lesions too much like those of hog cholera to serve regularly to differentiate the two diseases. Some may actually recover while others develop the chronic form and gradually waste away and die. In the chronic form, particularly when the affected animal has no fever, the lesions and the symptoms may be so much like those of nutritional necrotic enteritis as to be indistinguishable. However, if lesions resembling cholera are present and there is no evidence that they are due to necrotic enteritis or to something other than cholera, the diagnosis should be cholera.

Lesions of necrotic enteritis have occurred in experimental pigs fed diets deficient in some of the B vitamins. On such diets the pigs become unthrifty and rough haired; they lose their appetite, have diarrhea, and waste away and die. In similar field cases, the absence of red spots on the belly, the lack of fever, the slow development of the disease in the herd, and the fact that the lesions are confined principally to shotes, all serve to distinguish the condition from cholera. If the nutritional disease is accompanied by an infection such as by *Salmonella choleraesuis*, differentiation becomes increasingly difficult.

The third disease in which lesions of necrotic enteritis occur is hog cholera itself. Some investigators believe that many cases of necrotic enteritis are due primarily to hog cholera with secondary infections from other agents.

PNEUMONIA AND PLEURISY (SWINE PLAGUE)

There is much similarity between the symptoms of pneumonia and of cholera in swine. Many cases of cholera are accompanied with more or less solidification of the lungs. There is loss of appetite, disinclination to move, fast breathing, and elevation of temperature in both diseases. Usually in pneumonia comparatively few of the animals are sick at the same time. The temperatures of the sick hogs rarely exceed 104° F., while in cholera they usually are much higher; however, some hogs in the advanced stage of cholera show normal and even subnormal temperatures. Hogs suffering with pneumonia show a tendency to lie on their breasts to facilitate breathing. Death does not occur so quickly as in cholera. Small, red spots on internal organs and purple discoloration of the skin covering the ears and abdomen are common lesions found in cholera but not in pneumonia.

The symptoms of pleurisy are similar to those of pneumonia. Great skill is required to differentiate hog cholera from either pneumonia or pleurisy.

SCOURS OR DIARRHEA IN SUCKLING PIGS

Apparently there is no single cause for scours in suckling pigs, nor are the lesions constant. A post mortem examination may reveal evidence of irritation in the inner lining of the intestines, and there may be ulceration, but the characteristic lesions of cholera are not found.

WORMS

Growing pigs often suffer from infestation with worms, both in the lungs and in the intestines, but old hogs rarely show the effect of such infestation. The most important symptom produced by worms is general unthriftiness. Further information concerning worms and other internal parasites may be obtained from the United States Department of Agriculture or State Experiment Stations.

SWINE ERYSIPELAS

Swine erysipelas is most often manifested in the form of enlarged, tender arthritic joints. Many times this is the only symptom. In other forms of the disease, such as the so-called diamond-skin disease, numerous dark or black diamond-shaped elevations appear on the skin on various parts of the body. In severe cases, leatherlike crusts may form on the skin. The disease may also occur in the acute form.

The following symptoms and lesions, when present, serve to help in distinguishing swine erysipelas from hog cholera:

In chronic swine erysipelas cauliflowerlike growths may appear on the heart valves. The affected animals exhibit a shortness of breath, are easily exhausted, and may collapse when forced to move. As a rule, however, arthritis is the most frequent form.

A septicemic condition (blood poisoning) results in high temperatures and may cause a reddening (blushing) of the skin which is either patchy or generalized.

When disturbed in their bedding, hogs affected with acute erysipelas are surprisingly active in spite of stiff gaits and arched backs and will nose up to the trough, eat a bit, and then return to their beds. The eyes are bright, the average temperatures are higher, and the coloration of the skin usually appears earlier than in hog cholera. Depending on the nature and duration of the infection, all, some, or none of the above symptoms may be noted in an affected animal.

Often a laboratory examination is necessary to differentiate between swine erysipelas and hog cholera. It is possible for both diseases to be present in the same animal at the same time.

Whenever any of the above conditions are observed in a herd, consult a veterinarian who, with or without laboratory aid, may make a definite diagnosis and give specific recommendations.

MODES OF INFECTION IN HOG CHOLERA

Hog cholera does not occur in a herd except through the introduction of the specific virus of that disease. For many years it was generally accepted that the virus of hog cholera developed and propagated only in the bodies of hogs. However, since the middle thirties the virus has been grown on artificial media and has been transmitted to rabbits, sheep, and chickens. Although the possibility exists that animals other than hogs transmit cholera, there is no more certain way of introducing hog cholera than by placing in the herd a hog infected with the disease. A sick hog, then, must be regarded as the most dangerous agent in the spread of cholera. Hogs affected with cholera discharge the virus of the disease from their bodies in the urine, feces, and secretions of the nose and eyes. Therefore the manure, bedding,

litter of all sorts, and the dirt in pens where sick hogs are kept are contaminated with the virus of the disease. It may enter the hog's system by means of food or drink and probably also through wounds or abrasions of the skin.

The shipment, to market, of hogs affected with cholera has resulted in the infection of public stockyards, unloading chutes, and railroad cars used for hauling hogs. Consequently if healthy hogs are shipped in ordinary stock cars, or if they are unloaded in public stockyards or through public chutes, they are likely to become infected with cholera. Any agent which will serve to carry infected litter, manure, or material of any sort from public stockyards or cars to farms may result in an outbreak of cholera on the farm. Such infected material may adhere to the feet of horses or other livestock, to wagon wheels, rubber tires, or to the shoes of men who have entered these places.

What is true of public stockyards and stock cars is true of farms where cholera exists, and it may be expected that the disease will be carried from an infected farm to healthy herds if preventive measures are not taken. Streams passing through infected farms may carry the virus to other farms. If the carcasses of dead animals have not been disposed of promptly and properly, dogs may carry portions to neighboring farms. At certain seasons it is common for farmers to exchange labor and farm implements, when threshing, shelling corn, filling silos, and delivering grain or stock to market. Unless proper precautions are taken, these practices may serve to spread cholera. Cholera may be traced in some instances to the visits of stock buyers and vendors of stock remedies who go from farm to farm.

If hogs on a clean farm are not kept in properly fenced lots, they may range to contaminated streams or to adjoining herds and thus contract and spread cholera. It is undoubtedly true that in many cases infection results from the purchase of new stock, and at times from the borrowing and lending of stock for breeding purposes. There are records of many herds having become infected from the purchase of stock at public sales on farms where the disease existed. Some outbreaks have been reported to have been caused by failure to take proper precautions when taking animals to be bred on premises where sires were kept for public service. It has been common for cholera to appear in untreated herds fed on garbage. Feeding garbage containing scraps of uncooked pork and bones is responsible for many outbreaks of hog cholera as well as of other swine diseases, particularly vesicular exanthema and trichinosis.

Except for garbage produced and fed on a farm free from cholera, the only safe garbage to feed to hogs is garbage that has been thoroughly cooked.

Farms on which hog cholera has occurred may remain infected for a considerable time, and a second outbreak may result from this harbored infection.

KEEPING CHOLERA OFF THE FARM BY SANITATION

The foregoing facts make it clear that hog cholera may be spread in many ways, and that proper foresight and the exercise of all possible care by hog raisers can reduce greatly, if it does not entirely eliminate,

the danger from cholera. To help the farmer protect himself, the following suggestions are offered:

Streams running through hog lots are valuable as sources of water supply, but such a stream may be a carrier of infection; therefore, swine confined to lots or pastures with streams running through them should be immunized against hog cholera.

Hog houses, lots, and pastures should be placed away from public highways, and the houses should be arranged so that they may be readily cleaned and disinfected. They should be exposed so far as possible to sunlight, which helps to disinfect (fig. 3). Hog lots should not be used for yarding wagons and farm implements and should not be entered with teams and wagons, or trucks, particularly those returning from stockyards and public highways. Strangers should be excluded from hog lots unless there is reasonable assurance that they have not recently been where there is infection. Farmers and their help should disinfect their shoes and change their outer clothing before entering hog lots after returning from public stockyards, sales, and neighboring farms where infection is known to exist.

Compound cresol solution (U. S. P.), or a suitable substitute is a satisfactory disinfectant for use against hog cholera. A satisfactory substitute for compound cresol solution is cresylic disinfectant. Cresols are poisonous when taken internally, and cause burns if they come into contact with the skin, so special precautions should be taken when these substances are used. Ordinary lye may be used in disinfecting the premises. A 2-percent solution may be prepared by adding 1 pound of lye to $51\frac{1}{2}$ gallons of water. As lye is a caustic poison, care must be taken to avoid getting any of it in the eyes and inhaling any of the dust.



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Figure 3.—A sanitary individual hog house.

Mud wallows should be drained, filled, or fenced in. If a wallow is to be used, it should be made of concrete and designed for easy draining and cleaning.

Runs underneath buildings, which cannot be readily cleaned and disinfected, should be closed. Straw stacks that have been used as nesting places by sick hogs should be burned or removed to a field and plowed under. It is dangerous to leave remnants of stacks accessible to hogs from year to year, and new tenants should beware of this source of danger.

Hogs that do not recover fully from cholera should be destroyed, because they remain a constant source of danger.

Uncooked garbage or table scraps containing meat or bones should not be fed to hogs which have not been immunized against hog cholera.

All animals that die on the farm, as well as the entrails removed from animals at butchering time, should be properly disposed of by burning or burying. Unless disposed of in this way they may attract dogs or other animals which may carry the infection of hog cholera, tuberculosis, or other diseases to susceptible animals in the neighborhood.

Newly purchased stock, stock borrowed or lent for breeding purposes, and stock exhibited at public fairs should be placed in isolated pens and kept there for at least 21 days or longer before being allowed to mingle with the herd. During the quarantine, take care to prevent carrying possible infection from these pens to other swine on the premises.

If hog cholera appears on a farm the owner should voluntarily post a notice at the entrance to the premises reading "HOG CHOLERA—KEEP OUT," and all neighbors should be warned so that they may protect their herds. The infected herd should be confined to limited quarters that can be cleaned and disinfected frequently.

Dogs should not be allowed to run about in a community when hog cholera exists.

Strict application of sanitation, thoughtful foresight, and the exercise of all possible care by hog raisers would help to reduce losses from hog cholera.

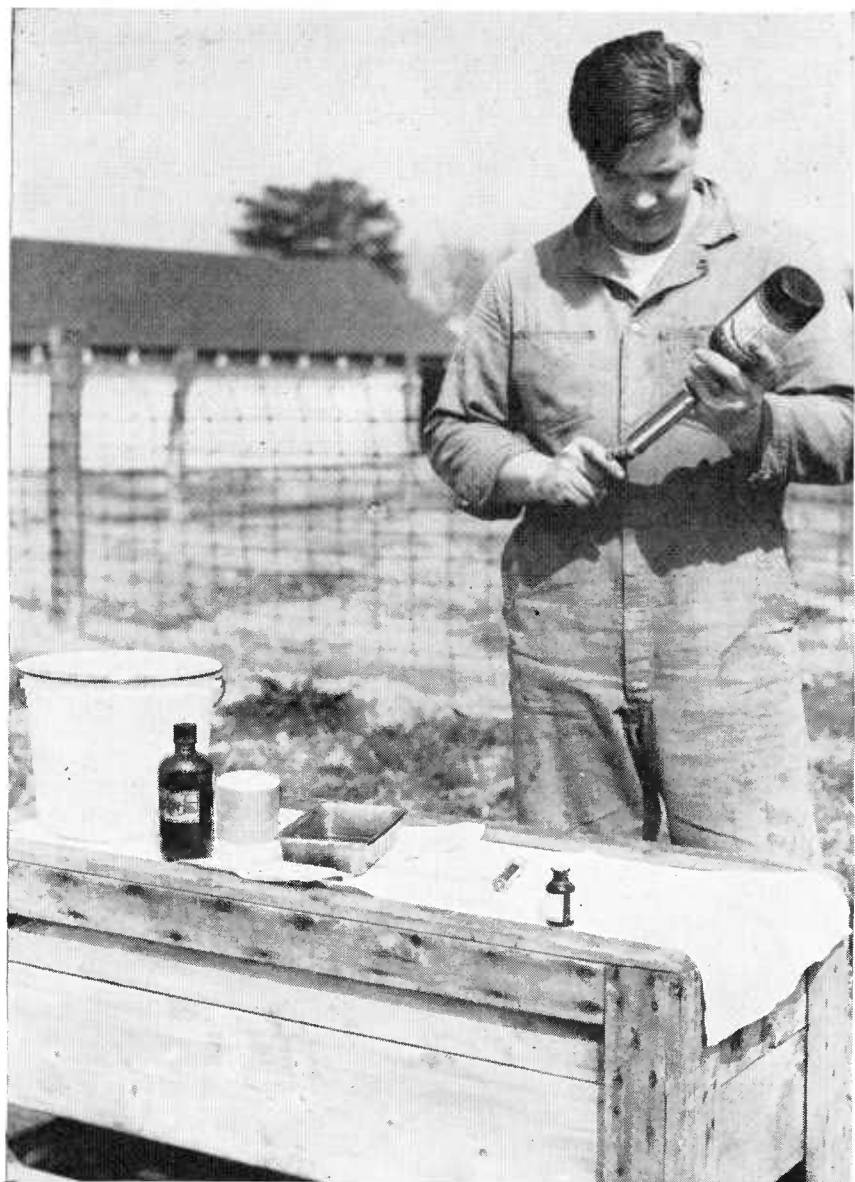
The difficulty is in getting all hog owners to take the necessary precautions.

PREVENTION BY IMMUNIZATION

ANTI-HOG-CHOLERA SERUM

Anti-hog-cholera serum is prepared from the blood of hogs that have been hyperimmunized against hog cholera. Hogs that are immune to this disease, either naturally, as a result of exposure to infection, or as a result of treatment with serum and virus, are injected with large quantities of blood from pigs sick of cholera. The blood from sick pigs—even in minute quantities—will kill susceptible pigs but does not injure immunes; on the contrary, it causes immunes to become more highly immune. After immunes are injected with virulent blood they are called "hyperimmunes." About 10 days or 2 weeks after an immune hog has been hyperimmunized its

blood contains a large number of protective antibodies, and it is from such blood that anti-hog-cholera serum is prepared. All anti-hog-cholera serum now produced under a license from the United States Bureau of Animal Industry is known as clear serum. This clear product is obtained by removing the red blood cells from blood derived from hyperimmunes. As red blood cells have no protective properties and represent a large part of the blood, clear serum is not so bulky as the earlier type, commonly called defibrinated blood



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Figure 4.—Veterinarian getting equipment ready for treating herd.

serum. The clear product is pasteurized to rid it of the causative agent of any disease. Clear serum is preferable to the crude defibrinated blood serum, and the cost per dose is no greater.

The fact that such a serum will protect hogs from cholera was first announced by the Bureau of Animal Industry in 1908-09. Following this, several State institutions began the preparation and distribution of the serum, and subsequently it was produced commercially. The efficacy of the serum is now recognized generally in the United States and in foreign countries.

This serum is regarded as most efficacious when administered as a preventive, although it seems to have some curative value if administered when hogs are in very early stages of the disease.

Little benefit can be expected, however, from the treatment of hogs that are visibly sick. Serum is primarily a preventive rather than a cure.

Beginning in 1913 the Bureau of Animal Industry experimented in 17 counties in 15 different States to explore the possibilities of reducing losses from hog cholera by a systematic campaign embracing limited quarantine, sanitary measures, and the use of the preventive-serum treatment. In these experiments 234,136 hogs in infected herds were treated with a loss of 13.1 percent, notwithstanding the fact that 85,547, or 36.5 percent of the number, showed high temperatures from disease or other causes at the time of treatment.

During the same period 19,208 hogs in uninfected herds were treated for protection, with a total loss, from all causes, of only 49 hogs or one-fifth of 1 percent. Most if not all of the 49 deaths probably were from causes other than cholera.

HOG-CHOLERA VIRUS

Hog-cholera virus is prepared from the blood of pigs that are sick with hog cholera. Their blood is defibrinated and mixed with a preservative to make whole-blood virus.

This virus is the active agent that produces the disease and is, therefore, potentially a very dangerous product. If improperly handled, it can cause an outbreak of hog cholera. All syringes or other equipment used with virus and the clothing of the one who administers the virus should be disinfected following use of the virus. The virus container should be burnt after use or placed in boiling water or a strong disinfectant such as 5-percent sodium hydroxide (common lye). It should be emphasized that when virus is brought on a farm, cholera may result if the virus is handled improperly.

METHOD OF USING SERUM AND VIRUS

Two systems of serum treatment are used in protecting hogs from cholera—the serum-alone treatment and the simultaneous inoculation.

Before beginning the treatment of an infected herd the sick and the apparently well hogs should be separated and each lot confined in a pen or inclosure that may be cleaned and disinfected. A catch pen, large enough to hold 8 or 10 pigs, should be made by placing a short gate across one corner of the inclosure nearest the operator. This will prevent worrying or exciting the whole herd. Otherwise the animals may run about and crowd together, thus causing an

elevation of temperature that may be misleading, especially in warm weather. It is advisable to withhold feed from all hogs in the herd for at least 12 hours before treatment, but they should be given all the water they will drink. Excitement of the herd during treatment is lessened by scattering shelled corn among the hogs.

An ample supply of hot water and clean pails should be on hand for preparing disinfectants and for use in keeping the instruments and the operator's hands clean.

The previously cleaned syringes and needles should be sterilized by boiling for 5 to 10 minutes before they are used. A table or bench, covered with clean towels, should be provided for the syringes and other instruments, and there should be a bucket containing a disinfectant for rinsing the hands of the operator (fig. 4).

Serum and virus should be drawn from the original containers directly into the syringes.

The needle should be removed from the syringe after each injection and placed in a small, shallow receptacle containing a disinfectant. A clean needle should be used each time an injection is made. Separate needles should be used for serum and virus. Needles should be of the smallest caliber that will conduct, without clogging, the product to be injected. If the nozzle of the syringe becomes soiled, it should be washed thoroughly with a disinfectant before further use. Cleanliness reduces the possibility of abscesses and blood poisoning.

Sufficient help should be provided to hold the hogs in proper position for treatment. Hogs that are too heavy to handle in any other way may be snared by the upper jaw and held as shown in figure 5. In such cases the injection is made in the fold of loose skin in front of the shoulder back of the ear. The most common method of injecting small pigs weighing up to 75 or 80 pounds is to hold them with their heads up and make the injection in the axillary region, between the foreleg and the body (fig. 6). Small pigs may also be held up by the hind legs with the forefeet resting on the ground, (as shown on cover page) and the injection made beneath the skin into the loose tissues of the flank. This is the most convenient way of handling a small pig, as it may be held by one man and is in a suitable position for taking the temperature, cleansing the areas of operation, and making the injection. Some veterinarians, particularly in the treatment of small pigs, practice injection into the abdominal cavity.

Injection into the ham should be avoided, because an abscess which may damage the ham may develop as a result of the injection. In some cases an abscess has not been discovered until the ham has been cooked and cut for use.

The temperatures of all hogs should be taken and recorded immediately before they are treated. Those showing temperatures of 104° F. or higher should be marked, if treated, so that they may be identified. The treatment of an animal with so high a temperature from cholera does not promise very satisfactory results. Hogs may be marked conveniently by placing a ring in the upper border of one ear.

It is an injustice to the operator, to the owner of the herd, and to the serum producer to administer serum to hogs without at the same time taking and recording the temperatures. It is not uncommon to find a herd which appears to be perfectly healthy, although at the time, many of the animals may have high fever. If a herd is treated



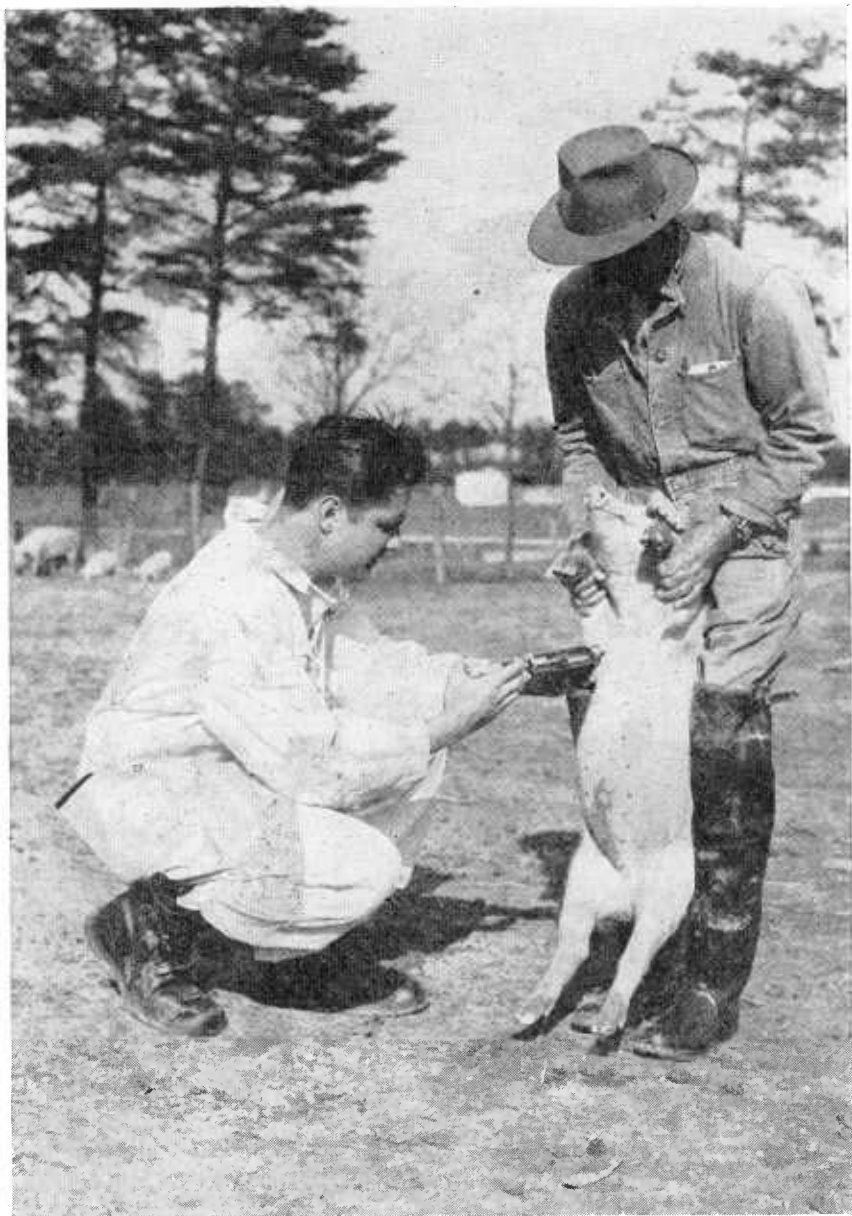
Figure 5.—Injection back of ear.

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without knowledge of the fever, the owner may be led to condemn unjustly the treatment or the man who applied it, for some losses are likely to occur.

Before the administration of serum or virus the skin covering the point of injection should be cleaned thoroughly and washed with a disinfectant or painted with tincture of iodine. The skin is then drawn slightly to one side, the needle inserted to the desired depth,

the injection made slowly, the needle withdrawn very gradually, and the needle wound pinched between the thumb and finger to prevent leakage. Not more than 10 cubic centimeters of serum in the case of pigs, nor more than from 20 to 30 cubic centimeters in the case of larger animals, should be injected into one place, unless the injection is made into the abdominal cavity.



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Figure 6.—Injection between foreleg and body (axillary space).

The virus should be injected on the opposite side of the body or, at any rate, at some distance from the serum.

Serum should be used with the understanding that it is a preventive rather than a curative agent. Hogs in an advanced stage of the disease should be destroyed, as they spread the infection and rarely make good recoveries.

SERUM-ALONE TREATMENT

The serum-alone treatment consists merely in injecting the serum which is obtained from hyperimmunized hogs. The serum may be used either to immunize healthy hogs or to treat those that are in the early stages of the disease. Good serum, properly administered, cannot cause hog cholera, since the serum does not contain the virus of the disease.

Unfortunately serum alone does not produce a permanent immunity against hog cholera. The length of the protected period which follows the injection of serum alone seems to depend to a certain extent on the peculiarities of individual hogs, which cannot be determined beforehand, and also to some extent on the dose of serum. Certain experiments have indicated that the immunity lasts somewhat longer in hogs which receive exceptionally large doses. Ordinarily a farmer may expect the immunity to last from 2 to 6 weeks following the treatment of healthy hogs with serum alone, but in some cases it lasts for 2 or 3 months. At times, when healthy hogs are treated with serum alone and shortly thereafter are exposed to cholera, they seem to acquire a permanent immunity, but this is not always the case. Serum alone cannot be depended on to produce a lasting immunity even though the treated pigs are promptly exposed to cholera.

That serum alone has some value in treating sick hogs is true within certain limitations. Ordinarily it is of benefit only in the very early stage of the disease, before the hog shows visible signs of sickness.

DOSE OF SERUM ALONE

The quantity of serum required for producing immunity is influenced by several conditions, chief among these being the condition and susceptibility of the pigs and the potency of the serum. There is no hard-and-fast rule, but as a general guide the doses in table 1 are suggested as minimums.

On account of the short period of immunity afforded by the serum-alone treatment, it is not recommended except when for some reason the simultaneous inoculation is not suitable or when only a temporary immunity is required. It is suitable, for instance, for sows in advanced pregnancy; also when in emergency it is necessary to immunize pigs affected by a condition or disease other than chlorea which has lowered their vitality so that they are not in fit condition to receive virus, or when an owner insists that a very sick hog be treated.

Some veterinarians, when treating suckling pigs, prefer to give a preliminary injection of serum alone, followed in a few weeks by the injection of serum and virus.

It is emphasized that the serum alone affords only a very temporary immunity. To obtain permanent protection it should be followed by the simultaneous treatment.

TABLE 1.—*Minimum doses of serum in the serum-alone treatment of healthy hogs*

Animal and weight	Doses of serum	Animal and weight	Doses of serum
	<i>Cc.</i>		<i>Cc.</i>
Suckling pigs-----	20	Pigs 90 to 120 pounds-----	45
Pigs 20 to 40 pounds-----	30	Pigs 120 to 150 pounds-----	55
Pigs 40 to 90 pounds-----	35	Pigs 150 to 180 pounds-----	65
		Pigs over 180 pounds-----	75

SIMULTANEOUS INOCULATION

In the simultaneous inoculation, hog-cholera virus and anti-hog-cholera serum are administered at the same time but in different locations. The virus alone would produce hog cholera, but when it is administered with an adequate dose of serum, it prevents serious sickness or death. The combined use of the two products results in immunity similar to that possessed by hogs that recover from a natural attack of the disease.

Experiments show that unless the treated hogs become visibly sick, they do not transmit the disease to susceptible animals with which they mingle, but as a precaution the treated hogs should be segregated for at least 3 weeks.

DOSAGE OF SERUM AND VIRUS

The virus, of course, is given in very small doses as compared with the serum. The minimum doses of virus and serum for simultaneous inoculation are indicated in table 2.

If the herd is infected the dose of serum should be increased for all apparently healthy hogs. Also those showing high temperatures or other evidence of disease should receive at least a dose and a half of serum. Many veterinarians make it a practice to administer from 10 to 25 percent more serum than is specified in the dosage table. They also administer regularly from 3 to 5 cubic centimeters of virus, which will do no harm if a sufficient dose of good serum is given at the same time.

While the serum alone has the advantage of being harmless, remember that it has the disadvantage of producing only a transitory immunity. The conditions are precisely reversed in the simultaneous inoculation. In this case the immunity is prolonged, and it is rare to find a hog, immunized properly by the simultaneous method, which has again become susceptible to cholera.

The principal objection to the simultaneous inoculation is the element of danger caused by the injection of the virus of cholera. If the serum is not of proper potency or not administered in sufficient dosages, if the hogs are not in proper condition to receive virus, if the hogs do not receive proper care after treatment, or if the work is not properly done, hog cholera may be produced. Nevertheless, the simultaneous inoculation can be administered with safety. Certain important things, however, are to be remembered. Use good serum and inject plenty of serum and virus. Give enough serum to pre-

vent any signs of sickness in the treated hogs. To get a lasting immunity it is not necessary to render the hogs visibly sick. Apparently just as firm immunity is obtained when the hogs show no symptoms of illness as when they are made sick by the injection. This treatment should be handled carefully, and those who have studied the question agree that the simultaneous inoculation, even in healthy herds, should be administered only by veterinarians or, where there are no veterinarians, by fully trained and experienced persons. (See Herds Infected with Cholera and Other Diseased Herds, pp. 21, 22).

TABLE 2.—*Minimum doses of serum and virus in simultaneous inoculation of healthy hogs*

Animal and weight	Doses of serum	Doses of virus
	(Cc.)	
Suckling pigs-----	20	At least 2 cubic centimeters of virus should be administered to each animal weighing more than 45 pounds; in the case of sucklings weighing less than 45 pounds, the dose may be reduced.
Pigs 20 to 40 pounds-----	30	
Pigs 40 to 90 pounds-----	35	
Pigs 90 to 120 pounds-----	45	
Pigs 120 to 150 pounds-----	55	
Pigs 150 to 180 pounds-----	65	
Over 180 pounds-----	75	

The prolonged immunity caused by the simultaneous inoculation is much to be desired for several reasons. It prevents the recurrence of cholera in treated hogs; it eliminates the additional expense of retreatment; and it affords a better opportunity to eliminate the virus of the disease from infected premises, thus ridding the neighborhood of a source of continuing danger.

It is highly important when applying the simultaneous inoculation to inject an ample dose of serum. In no case will harm be done by increasing the dose prescribed on the bottle labels. It is much better to give more serum and save the treated pigs at an added cost of a few cents than to lose them through failure to give serum enough. In general, the dose of serum required in the simultaneous inoculation may be said to depend upon the age, weight, and condition of the animal, but the amount of serum required is not in direct proportion to the weight, for small pigs and shotes require larger doses in proportion to their weight than older animals, and ALL classes of hogs which show high temperatures should be given larger doses of serum than healthy hogs.

The syringes used for injecting the virus should be in perfect order, so that the quantity of virus desired is actually injected into and retained by each animal. If the virus should not be virulent, the effect of the treatment would be the same as if serum alone were administered.

TREATMENT OF HERDS

HEALTHY HERDS

No definite rule can be laid down as to the necessity for treating healthy herds. In general, the necessity for the treatment of healthy

herds depends on existing conditions, that is, the proximity of cholera and the ability of the farmer to protect his herd from infection. It has been demonstrated that susceptible hogs may be kept within a few feet of cholera hogs without becoming infected if sufficient care is taken to prevent the infection from being carried from the sick to the healthy animals. On the other hand, it has been noticed in practice that at times herds on farms immediately adjoining outbreaks of cholera may escape the disease, while herds several miles away become infected. It is probable that all the ways in which cholera spreads are not yet fully understood, but it is known that there are certain channels through which cholera frequently is carried from farm to farm. Cholera is produced only by conveying the infection in some way from sick hogs or infected premises to susceptible hogs.

At times herds on farms adjoining those where there is an outbreak of cholera may escape the disease. Even so, it seems to be good practice for farmers to protect their herds by inoculation when cholera exists in the neighborhood, or if garbage or table refuse is fed. Many farmers make it a regular practice to immunize their pigs at about weaning time or before.

The serum-alone treatment does not give immunity of sufficient duration to recommend it under such circumstances. In general, it is better to use the simultaneous inoculation, provided it can be given by a veterinarian or, if one is not available, by a fully trained and experienced person. After a healthy herd has been immunized in this way it should be kept segregated for at least 3 weeks. In case the disease appears in a herd after treatment, the hogs should be promptly treated again with serum alone, or, if the entire herd is not treated again, at least those animals showing high temperatures or visible symptoms of the disease should receive another injection of serum.

HERDS INFECTED WITH CHOLERA

In the field experiments conducted by the Bureau of Animal Industry during 1913, 1914, and 1915, in some of the counties, the serum-alone treatment was used exclusively, while in others all the apparently healthy hogs in diseased herds received simultaneous inoculation, except those showing temperatures above 104° F., which received the serum alone. So far as the results of treatment are concerned, the losses from cholera were practically the same in the two sets of counties. However, in those counties where serum alone was used on all hogs, in diseased herds there was some recurrence of disease among the treated hogs. In other words, the healthy hogs in the diseased herds were protected for a short time but later lost their immunity. Since the infection was still on the farm, they then contracted cholera.

In the counties where the simultaneous inoculation was used on all apparently healthy hogs in infected herds, there were comparatively few cases of recurrence of disease, and where there were any recurrences they were among hogs which received the serum alone. In other words, some hogs supposed to be infected when treated and which, therefore, received serum alone were probably not actually sick of cholera. They were protected for the time being, but later lost their immunity and contracted cholera from the infection which remained on the premises. In those herds in which the sick hogs received serum alone and the apparently healthy hogs received the

simultaneous inoculation, the results would perhaps have been still better, so far as recurrence of disease is concerned, if hogs showing temperatures above 104° F. had also been given the simultaneous inoculation.

OTHER DISEASED HERDS

Experiments indicate that hogs in normal condition usually withstand the simultaneous treatment without showing ill effects. It is unwise to administer virus to hogs while they are affected with hog "flu," swine erysipelas, pneumonia, necrotic enteritis, or other disease or condition which lowers their vitality. Apparently many of the "breaks" and consequent losses which occur soon after treatment are the results of administering virus when the animals are not in the right condition to receive it.

Herds which are not thrifty or show some evidence of an abnormal condition, require special handling and treatment. Ordinarily the farmer is untrained in the differential diagnosis of animal diseases and their treatment. It follows that he should consult a veterinarian both to restrict his losses to the minimum and to prevent the spread of infection to herds of neighbors. Causative agents of animal diseases, such as the virus of hog cholera, should be administered only when definitely indicated and under controlled conditions. The potential dangers involved in such cases should be recognized by both the farmer and the veterinarian.

CARE OF HOGS AFTER TREATMENT

Hogs should receive proper care after treatment.

The grain ration should be restricted to not more than two-thirds of the usual quantity for 2 weeks after simultaneous treatment. It is not advisable to feed corn during this time. Shorts, middlings, bran, ground or soaked oats, crushed rye, barley, kafir, tankage, skim milk, and buttermilk are suitable feeds that may be used in formulating a suitable diet. For best results reduce the grain ration about three-fourths and at the same time allow the treated hogs to graze and exercise in a clean pasture in which there are no running streams or mud wallows. They should have a plentiful supply of clean drinking water at all times. Sleeping quarters should be kept clean, dry, and well bedded.

If it is necessary to confine the animals, their pens should be light, airy, dry, clean, and well bedded. Keep feed troughs clean, preferably by scrubbing and scalding with hot water.

At the end of 2 weeks, if the animals are doing well, add some corn to their diet and gradually increase to full feed.

BREAKS IN IMMUNITY

EARLY BREAKS

In comparatively rare instances the simultaneous inoculation of an apparently healthy herd may result in infection in some or all of the animals. In such an event, symptoms of illness will usually be noted within 10 days after inoculation. The appearance of symptoms at such a time calls for the immediate attention of a veterinarian.

Such an occurrence is frequently referred to as a "serum break" because there is evidence that the serum has not fully protected. This might be due to insufficient dosage of serum, secondary infections such as pneumonia, hog flu, enteritis, etc., or to improper care and feeding conditions. Another recently discovered possible cause is a variant virus in the serum-virus treatment.

A variant virus was responsible for breaks in the summers of 1949 and 1950, when serious losses were reported in the Corn Belt following the use of serum and virus. These losses occurred within a week or two following treatment and were investigated in the field. Materials were collected and laboratory studies undertaken at both the Pathological Division's Animal Disease Station at Beltsville, Md., and the Hog Cholera Research Station at Ames, Iowa.

In the field investigations, the use of some serials, or particular batches, of virus regularly resulted in untoward reactions in the herds. In some herds, all the animals became sick, in others only a few, and in still others, none. Most of the affected animals sickened 6 to 10 days after treatment. In herds containing pigs of different ages, trouble seldom occurred in the younger pigs.

Numerous tests were made of serums and viruses used in these outbreaks. No pathogenic contaminants were found. Animals that had been treated previously with commercial serums and viruses remained well when injected with the viruses that were used in the breaks in the field. However, many serums which would protect in doses much smaller than prescribed for field use against ordinary hog cholera virus when simultaneously administered would not protect against the variant form in prescribed and even larger doses, but would protect if the dose were considerably increased. On the basis of field observations and laboratory findings, it was concluded that a hitherto unrecognized form of hog-cholera virus, now designated variant virus, was one of the factors responsible for some of the losses in the field in 1949 and 1950. It was recommended that the minimum dose of serum be increased by 25 percent and that pigs be treated before or soon after weaning. The recommended doses are given in table 2. Insofar as is known, no breaks due to variant virus have occurred since these recommendations were made. Experiments are still being conducted to discover more about variant virus. Immediate retreatment of herds in which early breaks occur is usually beneficial.

LATE BREAKS

"Late breaks," called also at times "virus breaks," constitute another form of trouble after simultaneous inoculation. These are cases in which pigs have been treated with serum and virus and have remained well after treatment, perhaps for several months, when they become sick with hog cholera. This shows a lack of immunity and is not always so easy to explain as are the early breaks. As these pigs may have varying degrees of immunity, the symptoms in the sick pigs and the lesions in pigs that die may differ considerably from those observed in pigs that have never been treated. Consequently, such a "late break" may frequently be diagnosed erroneously, particularly in the early stages of the outbreak. In the differential diagnosis of diseases of swine the possibility that the trouble may be due to a "late break" should always be considered. A late break may result from the fact

that the virus was not potent enough to produce the necessary reactions in the treated pigs.

In some cases late breaks were in herds which apparently had been treated with good virus, although, of course, that can hardly ever be determined positively. There are some scientific findings to show that swine, although properly immunized, may become temporarily susceptible to hog cholera because of other diseases. In other words, the immunized herd may contract a disease which in itself may not prove fatal, yet which, during the period of such infection, may put the animals in such condition that they can contract cholera. Then if the herd happens to be exposed to cholera during such a period, a late break may develop. The best procedure in the case of a late break is immediate retreatment of the entire herd with ample doses of serum alone. The simultaneous inoculation should be given only when it is clearly established that the sickness among the hogs is caused by uncomplicated hog cholera.

EFFECT OF TREATMENT ON PREGNANT SOWS

The question is frequently raised as to the advisability of administering serum and virus, or even serum alone, to pregnant sows. Decision probably should be governed somewhat by the condition of the herd. If infection has already appeared, it is generally conceded that without treatment the loss will be from 80 to 85 percent of the herd and that pregnant sows will probably abort. Also sows that live through the disease will not breed until they have recovered fully. Therefore there can be no question as to the advisability of treating sows in infected herds, regardless of the stage of pregnancy. Even though there can be no hope of saving the litters there is a possibility of saving the sows and of enabling them to recover more rapidly and in better condition than if they were not treated. It is considered advisable to avoid the simultaneous inoculation of sows that are very near farrowing time. In such cases serum alone should be used, and followed later by the simultaneous inoculation.

The method of treatment for sows that are not near farrowing is a matter of choice, since the results, so far as abortion is concerned, are practically the same. Statistics on the subject are shown in table 3.

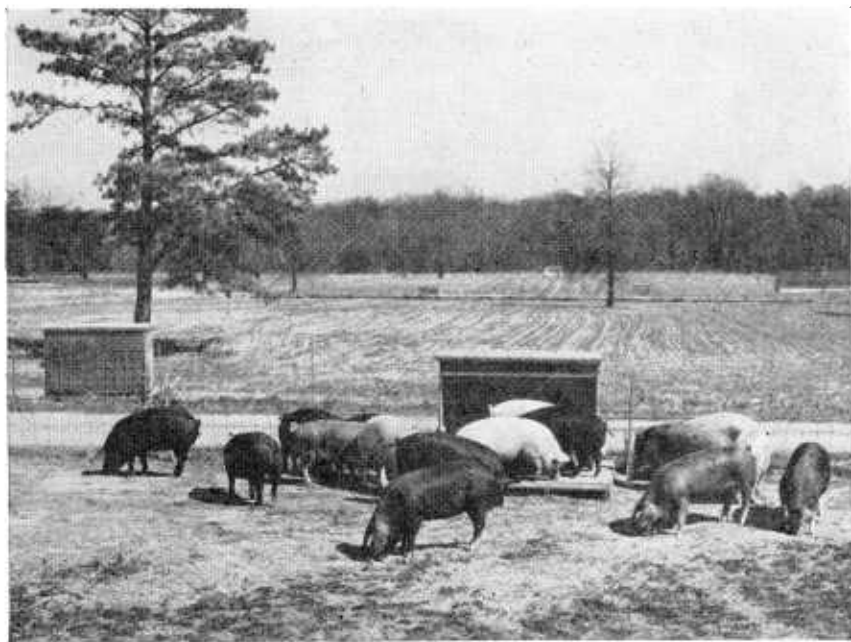
TABLE 3.—*Observations following treatment of pregnant sows in infected and in healthy exposed herds*

Method of treatment	Sows treated	Sows aborting	
	Number	Number	Percent
Infected herds:			
Serum alone.....	3, 235	261	8. 0
Simultaneous.....	1, 357	98	7. 2
Healthy exposed herds:			
Serum alone.....	126	2	1. 5
Simultaneous.....	28	0	0

EFFECT OF SIMULTANEOUS INOCULATION ON FERTILITY

In connection with field experiments, 2,362 healthy brood sows in 181 herds received the simultaneous inoculation, and 95 percent of

them produced pigs the following year. During the same time observations were made of 1,840 healthy sows, on 148 farms, that were not treated, and 94 percent of these produced pigs the following year. (See table 4.) From these observations it is fair to conclude that the simultaneous method when properly applied to healthy brood sows does not produce sterility (fig. 7). Occasionally hyperimmune sows—that is, sows that are used for serum production and have received enormous doses of hog-cholera virus—have farrowed normal litters.



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Figure 7.—Immunized hogs ready for market.

TREATMENT OF YOUNG PIGS

Pigs may be treated with serum alone or with the simultaneous inoculation, regardless of age. If young pigs receive both serum and virus, the immunity, as a rule, is lasting, and only an exceptional herd or individual will then contract cholera. Pigs from sows which passed through the disease before farrowing rarely contract hog cholera during the suckling period, but after weaning they soon become susceptible. Therefore, if cholera should appear on the premises or in the neighborhood such pigs should be treated in the same way as the remainder of the herd.

Although it has been repeatedly shown that very young pigs can be given lasting immunity by the simultaneous inoculation, it is probably also true that more careful discrimination is required than when the same treatment is applied to older hogs. This is because young pigs are susceptible to many diseases and are more easily affected by adverse conditions than older hogs. In administering the simultaneous inoculation to young pigs it is therefore especially im-

portant to be sure that they are in good health. If pigs are unthrifty from parasitic infestation, or from any other cause, if they show signs of thumps or other abnormal conditions, the simultaneous inoculation should be postponed until they are restored to complete health. In urgent cases in which the pigs must be immunized immediately, it is better to use serum alone if the pigs are not in good condition at the time. The simultaneous inoculation can be given at a later date.

The immunization of suckling pigs has much to recommend it in the way of decreased cost and increased protection. By immunizing early, less serum is required, and the pigs are protected sooner. Since the successful immunization of suckling pigs does not necessitate the reduction of feed, it is possible that the practice would enable farmers to market their pigs somewhat earlier than if the immunization were delayed until after weaning.

TABLE 4.—*Summary of investigations as to effects of simultaneous inoculation on fertility of brood sows*

Healthy brood sows	Herds	Sows	Produced pigs following year
	<i>Number</i>	<i>Number</i>	<i>Percent</i>
Inoculated with serum and virus.....	181	2,362	95.0
Not treated.....	148	1,840	94.4

HOG CHOLERA VACCINES

Progress has been made in the development of hog-cholera vaccines, and vaccines are being produced commercially and used widely in the United States and other countries. Two general types of vaccine have been developed. One type comprises vaccines made from the blood or from tissues, chiefly spleens (melts), of cholera-infected pigs. Vaccines of this type are known as vaccines of blood origin or vaccines of tissue origin. They resulted from the discovery that blood and tissues of cholera-infected pigs can be treated with chemical agents and heat in a manner which destroys the disease-producing properties without affecting the antigenic or immunizing properties. The vaccines of blood origin and of tissue origin have been in use in this country and in other countries for several years. The chief advantage of these vaccines is that they produce immunity but do not introduce active virus into the hogs. These vaccines do not confer an immediate immunity such as follows serum-virus treatment, and the immunity they produce may not be so lasting.

Vaccines of a new type known as hog-cholera vaccine, modified live virus, rabbit origin or swine origin, have recently been developed by passing hog-cholera virus through rabbits. There are two subtypes of these vaccines. In one the vaccine is derived directly from rabbits and is usually used without serum, but may be used with serum if immediate protection is desired. The other subtype is obtained from swine injected with rabbit virus and is always used with serum. To obtain these vaccines, virulent virus is first transferred to a rabbit and then repeatedly transferred from rabbit to rabbit. The purpose

of the passage through rabbits is to modify the virus so that it will no longer produce the disease when injected into hogs but will produce immunity. A third type grown on tissue culture has also been developed. The modified live virus vaccines have been subjected to extensive laboratory tests and field trials. As results are obtained and evaluated, recommendations will be amended to keep pace with new developments.

The exact time required for a pig treated with vaccine alone to develop immunity and the exact duration of immunity have not as yet been determined for any type of vaccine. However, with vaccines alone, a considerable degree of immunity may develop as early as the seventh day, and in controlled experiments, immunity has been found to persist with crystal-violet vaccine for as long as 400 days and with some of the newer modified vaccines for 2 years—the longest intervals at which the tests have been made.

The older types of vaccines, that is, those of blood and of tissue origin, have been found particularly useful in herds which usually react severely to the serum-virus treatment and also in herds where secondary infections are known or are likely to exist, either in the animals or on the premises.

Severe sickness and sometimes heavy death losses result from virus reactions combined with secondary infections or other debilitating conditions following the treatment with serum and virus. Many herds affected with necrotic enteritis have been treated with the older type of vaccine without influencing the course of that disease. Most veterinarians consider it dangerous to use virus in such herds. So far, the newer vaccines are recommended only for the immunization of healthy swine. Consult your veterinarian for advice on the use of immunizing agents.

RESTOCKING AFTER AN OUTBREAK OF HOG CHOLERA

In some instances the infection of hog cholera disappears from premises within a few weeks, but in others it remains for months. The infection is more likely to be eliminated quickly in summer than in winter. This probably results from putrefaction and fermentation of infected material. Experiments have shown that the virus of hog cholera is usually destroyed by those processes. In the cold months of winter, putrefaction and fermentation are less active, and infection persists longer. There is no reliable information as to the exact time required for the elimination of infection on farms through natural agencies.

Sick hogs are a constant menace to nonimmune hogs; therefore, susceptible hogs should not be placed on a farm so long as any sick hogs remain on the premises, nor should they be brought to a farm where infection has existed until after the premises have been cleaned and disinfected. Burn all old troughs, rubbish, litter, and other material that may be contaminated. As a general rule, the introduction of susceptible hogs onto previously infected farms cannot be regarded as safe at any season until at least 3 months after removal of the last sick hogs, unless the premises have been effectually cleaned and disinfected. As a precaution, immunize new litters farrowed on the premises, and also new stock brought to the farm within 90 days after

all the sick hogs have recovered. If possible, provide new runways and feed lots.

DRUG REMEDIES

No drug or combination of drugs is known at present that can be regarded as a preventive or cure for hog cholera in the true sense of the word. From time to time preparations appear on the market composed of drugs and chemicals, which are advertised to protect hogs against cholera or to cure hogs affected with the disease. All of the so-called cures that have been tested by Federal and State institutions have been found to be worthless as preventives or cures for hog cholera. Farmers therefore, are warned against investing their money and placing their faith in hog-cholera medicines. "Anti-hog-cholera serum," prepared according to the methods worked out by the Bureau of Animal Industry, was formerly the only agent known that could be regarded as a reliable preventive. However, the vaccines previously mentioned in this bulletin have proved satisfactory when used according to directions, and the commercial production and use of them are increasing rapidly.

FACTS ABOUT HOG CHOLERA

To Avoid Hog Cholera

LOCATE hog lots and pastures away from public highways. Unless they have been immunized, do not allow hogs to run on free range or highways, nor to have access to canals or irrigation ditches.

Do not visit a neighbor's farm nor allow him to visit yours if there is hog cholera on either place.

Do not drive into a hog lot after driving on a public highway.

Do not use hog lots for yarding wagons, trucks, and farm implements.

Do not immediately place with your herd newly purchased stock, stock procured or borrowed for breeding purposes, or stock exhibited at fairs.

Keep such stock quarantined in separate pens for at least 3 weeks. In feeding and attending such stock take care to avoid the possibility of carrying infection from these animals to other pens.

Burn to ashes or cover with quicklime and bury under 4 feet of earth all dead animals and the inedible viscera removed from animals at butchering time, because they attract buzzards, dogs, etc., which may transport and spread hog-cholera infection.

If hog cholera appears in the neighborhood, confine your dog and encourage your neighbor to do the same.

To Combat Hog Cholera When It Appears

Have all hogs immunized against cholera immediately with serum alone or with virus and serum as described in this bulletin, after which they should be kept on a light diet for a short time. An abundance of pure drinking water should be supplied, and the treated hogs should be kept in clean, sanitary quarters.

To obtain the best results the treatment must be administered as soon as the disease can be detected in the herd. Be sure that the temperature of each hog is taken. A temperature above 104° F. in ordinary weather and when the animal is not excited indicates disease and the necessity for an increased dose of serum.

To Rid Premises of Infection

Remove the manure from the infected pens and yards and spread it or place it in piles where it is not accessible to swine.

Burn all litter, rubbish, and old hog troughs. Keep hogs away from old strawstacks.

After the premises are thoroughly cleaned, spray walls, floors, and other surfaces with a recognized disinfectant. Scrub hog troughs with hot water. Where hog houses are small, turn them over, exposing the interior to sunlight. Mud wallows should be filled in, drained, or fenced off.

All runs underneath buildings should be cleaned and disinfected and then boarded up to keep hogs out.

Destroy hogs that do not fully recover, as they may be carriers of cholera infection.

IMPORTANT FACTS

About the Serum Treatment

The simultaneous (virus-serum) inoculation gives hogs a lasting immunity against cholera.

This treatment consists in inoculating the hog with a small quantity of the virus and at the same time injecting an effective dose of anti-hog-cholera serum.

Ample doses of good serum and virus properly administered are necessary for success.

The treatment preferably should be given by a veterinarian.

Serum-alone treatment gives temporary protection, usually lasting only 2 to 6 weeks.

IMPORTANT FACTS

About Vaccine Treatment

Vaccines are incapable of producing hog cholera.

Vaccines alone do not confer immediate immunity and should not be used when hog cholera is present, or when hogs may be exposed to cholera.

The duration of immunity for vaccines has not as yet been determined. To be safe, breeding stock should be revaccinated once a year.